

<b>GEARTECH</b>	QUALITY PROCEDURE	No. QP8506	SHEET 1 OF 3	
		Rev. A		
Inspection by Magnetic Particle		BY RLE	DATE	11/06/01
		CKD JRM	DATE	11/06/01
<div>1. Scope</div> <div>1.1 This procedure covers magnetic particle inspection used to detect cracks and other discontinuities at or near the surface in ferromagnetic materials.</div> <div>1.2 This procedure does not apply to shot blasted or shot peened areas of parts.</div> <div>2. Referenced Documents</div> <div>2.1 ASTM E 709 Standard Practice for Magnetic Particle Examination.</div> <div>2.2 ANSI/AGMA 2001-C95 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.</div> <div>2.3 GEARTECH Specifications: CK8506 QP8506 Inspection by magnetic particle</div> <div>3. Terminology</div> <div>3.1 Indication- Accumulation of magnetic particles caused by distortion of the magnetic field at surface discontinuities such as cracks and near surface discontinuities such as inclusions.</div> <div>3.2 Standardized test specimen- A specimen with known indications used to verify effectiveness of the magnetic particle inspection procedure.</div> <div>3.3 Magnetic field indicator- A copper-plated pie gauge in accordance with Figure 17 of ASTM E 709 used to verify strength and direction of a magnetic field.</div> <div>4. Significance and Use</div> <div>4.1 Application- Magnetic particle inspection is used to detect cracks and other discontinuities such as inclusions in ferromagnetic materials. It may be applied to raw material, semi-finished parts, and finished parts regardless of heat treatment.</div> <div>4.2 Process control- Risk of cracking during grinding varies with grinding parameters such as grinding wheel type, wheel dressing, feed, speed, and coolant, and workpiece microstructure such as retained austenite, hardness, and carbide networks. Magnetic particle inspection is useful for monitoring process control of grinding.</div> <div>5. Apparatus</div> <div>5.1 Process equipment and materials- The wet particle technique shall be used in accordance with ASTM E 709.</div> <div>5.2 Magnetization technique- The wet continuous magnetization technique shall be used. The inspection medium shall be applied to the surface of the part and its application terminated simultaneously with the initiation of the magnetizing current.</div> <div>5.3 Magnetizing current- single phase half-wave rectified alternating current (HW) or three phase full-wave rectified alternating current (FWDC) shall be used.</div>				

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5.4	Direction of magnetization- Both direct and indirect magnetization shall be used to create circular and longitudinal magnetic fields. For circular magnetization of hollow parts, the magnetizing current shall pass through a conductor rod passing through the bore of the part.			
5.5	Black light- Inspection shall be performed in a darkened enclosure using a black light having a wave length of approximately 3650 Angstrom units and an intensity in accordance with ASTM E 709.			
5.6	Standardized test specimen- The standardized test specimen shall be a gear or sector of gear teeth with known crack indications.			
6.	Test specimens			
6.1	Production parts- Magnetic particle inspection shall be performed on parts after all grinding is completed and before any shot peening.			
7.	Procedure			
7.1	Specification conformance- The test procedure and apparatus shall conform to ASTM E 709.			
7.2	Verification of test procedure- The effectiveness of the magnetic particle inspection procedure shall be verified before any inspection. At each verification, the standardized test specimen shall be inspected with the same procedure used to inspect production parts.			
7.3	Calibration of test procedure- If verification of the test procedure does not reproduce the known indications on the standardized test specimen, the test procedure shall be adjusted and the verification shall be repeated until the known indications are reproduced.			
7.4	Verification of magnetic field- The strength and direction of the magnetic field shall be verified in the area of interest on the part being tested using a magnetic field indicator.			
7.5	Areas inspected- Unless otherwise specified on the engineering drawing for the part, 100% of all exterior surfaces shall be inspected.			
7.6	Prevention of overheating- In all cases, current intensity, duration of current, and soundness of direct contact shall be controlled so the part being tested is not heated above 65°C (150°F).			
7.7	Demagnetization- After magnetic particle inspection is complete, all parts shall be demagnetized to 2 Gauss maximum.			
7.8	Cleaning- After magnetic particle inspection and demagnetization is complete, all parts shall be flushed with clean solvent to remove all magnetic particles.			
8.	Interpretation of results			
8.1	Indication type- Indications shall be assessed and classified as surface discontinuities or near surface discontinuities.			
8.2	Indication severity- Indications shall be assessed and classified with respect to location, direction, frequency, and size.			

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<div>9. Acceptance criteria</div> <div>9.1 Gear teeth- Unless otherwise specified on the engineering drawing for the gear, indications on gear teeth shall meet the acceptance criteria of ANSI/AGMA 2001-C95 for grade 3 carburized gears.</div> <div>9.2 Other features- Unless otherwise specified on the engineering drawing for the part, the following shall apply:</div> <div>9.2.1 Splines- There shall be no indications on spline teeth or in the runout area of splines,</div> <div>9.2.2 Keyways- There shall be no indications in keyways,</div> <div>9.2.3 Bearing journals- There shall be no indications on bearing journals, and</div> <div>9.2.4 Shaft shoulders- There shall be no indications at shaft shoulders.</div> <div>10. Report</div> <div>10.1 The report shall include the following:</div> <div>10.1.1 Record of indications showing location, direction, frequency, and size. Records may be sketches, transfer tapes, or photographs,</div> <div>10.1.2 Record of magnetizing current (HW or FWDC),</div> <div>10.1.3 Record of magnetic current strength,</div> <div>10.1.4 Record of verifications, and</div> <div>10.1.5 Record of calibrations.</div>				